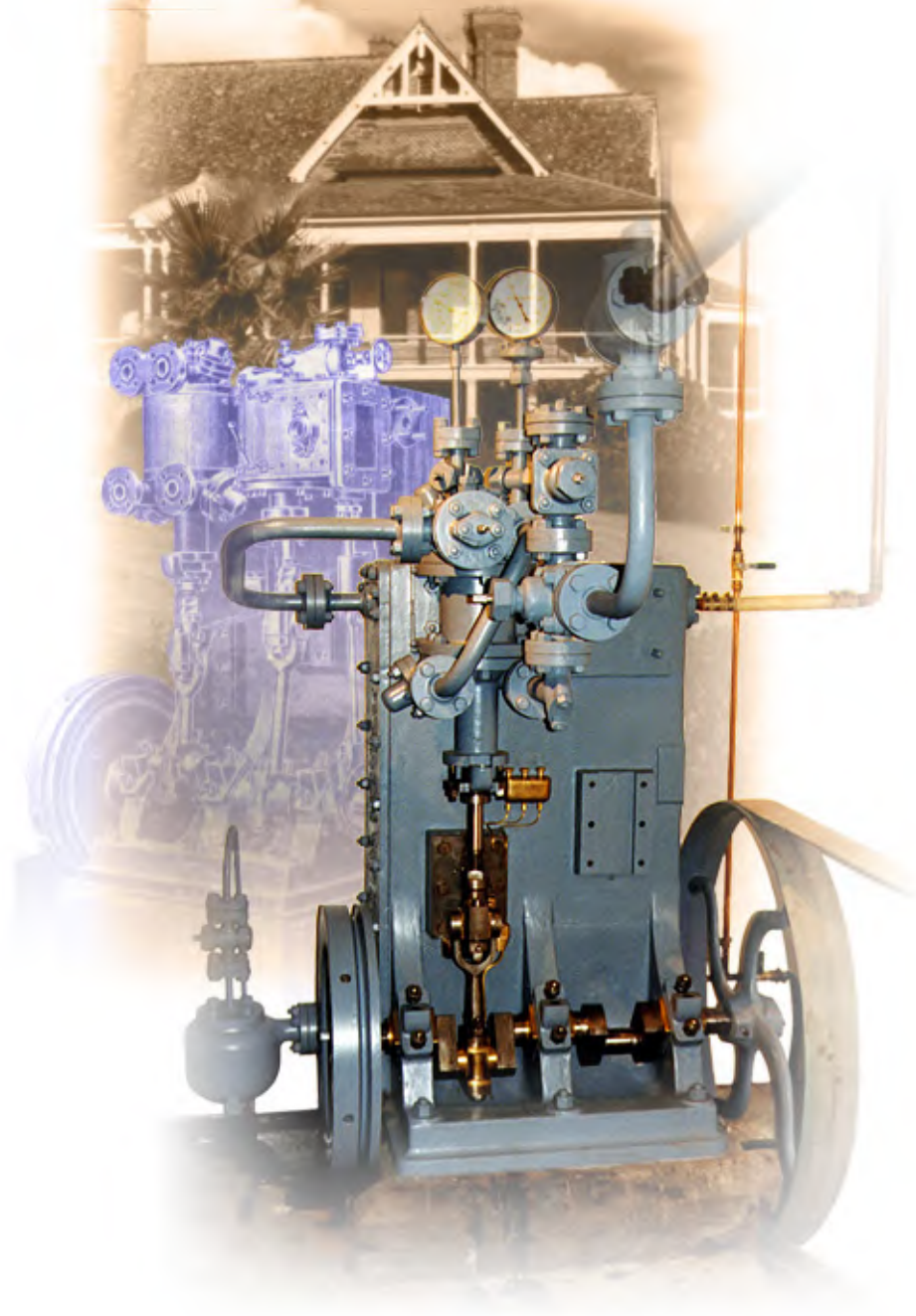


HISTORIC ENGINEERING MARKER

**URRBRAE HOUSE
REFRIGERATION PLANT AND COLD
ROOMS**

PLAQUING REPORT



**By the South Australian Division
The Institution of Engineers Australia**

Date: 27 April 1999

URRBRAE HOUSE REFRIGERATION PLANT AND COLD ROOMS

HISTORIC ENGINEERING MARKER PLAQUING REPORT

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HISTORIC ENGINEERING MARKER: URRBRAE HOUSE REFRIGERATION PLANT AND COLD ROOMS

The refrigeration plant and cold rooms in Urrbrae House on the Waite campus of the University of Adelaide were nominated for an Historic Engineering Marker in February 1996 by the Engineering Heritage Branch of the Institution of Engineers Australia, South Australian Division. The nomination was prepared by Dr John Pickles, supported by the University committee (the RARE Committee) overseeing the restoration of the plant.

The plaque was dedicated at a ceremony on 17 April 1996 as part of the formal opening of the National AIRAH Conference.

The marker has been mounted by the Waite Institute in a prominent position on the wall adjacent the front door of Urrbrae House. The House is an important part of the Waite Historic Precinct.

The marker was unveiled by the President of the South Australian Division, Mr Craig Parsonage. Supporting addresses were given by the Dean of Agricultural Science and Acting Director of the Waite Institute, Prof Malcolm Oades; the chair of the RARE Committee, Mr Ray White; and the chair of the SA Engineering Heritage Branch, Mr Deane Kemp.

The ceremony was attended by an estimated 120 people.



GLOSSARY AND ABBREVIATIONS

AC	Alternating current
AIRAH	Australian Institute of Refrigeration Air Conditioning and Heating
DC	Direct current
psig	Pounds per square inch gauge (pressure above atmospheric)
RARE	Restoration of Ancient Refrigeration Equipment

Statement of Significance

The refrigeration system and associated cold rooms in the basement of Urrbrae House on Waite Campus of the University of Adelaide is the earliest known application in Australia of the then current commercial refrigeration practice for domestic use.

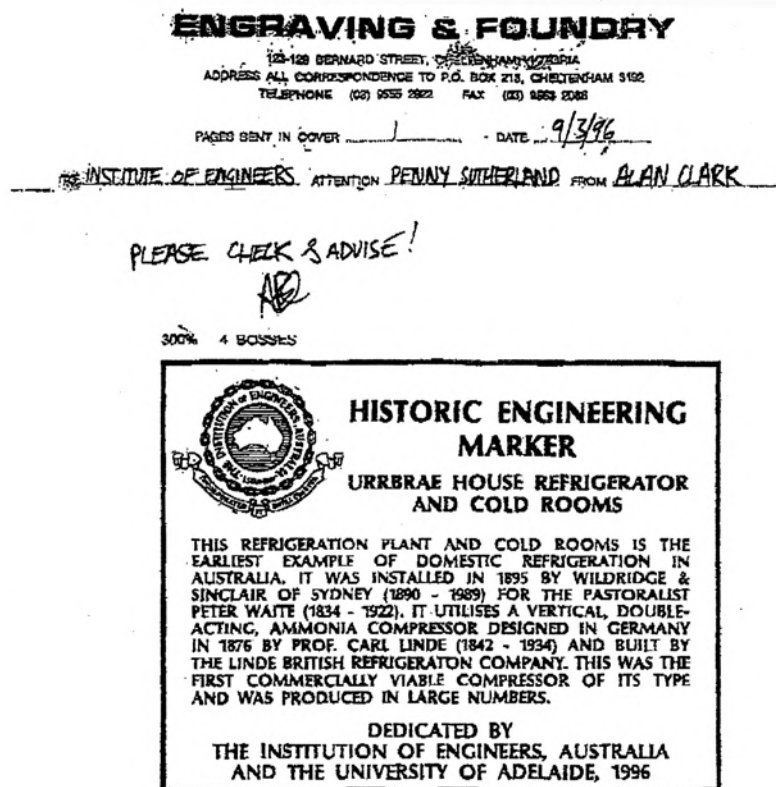
The design and installation of this innovative system was contracted by pastoralist Peter Waite to the firm of Wildridge & Sinclair of Sydney. It was installed in 1895 and, according to an early catalogue, it was Wildridge & Sinclair's first domestic installation. The firm has only recently (1989) gone out of business.

The ammonia compressor was manufactured by the Linde British Refrigeration Company under the design supervision of the German academic and industrialist, Professor Carl Linde, who had introduced the ammonia machine in 1876. The design of this compressor differs little from the earliest machines and the design was the first to be produced in large numbers.

The design of the compressor reflects established steam engine technology of the time. The piston is double acting, driven by a crankshaft running at 120 rpm, and the operating pressures of 20 psig and 170 psig were similar to those used in contemporary steam plant.

The compressor provides an interesting instance of the era of transition from steam to electric power. The frame and crankshaft have provision for the mounting of a steam cylinder to power the machine but, in this installation, an electric motor was used.

The plant appears to be unchanged since its original installation; the original colour-washed layout drawing survives. All the equipment and components are original, apart from the 32 volt DC electric drive motor which is missing. This has been replaced with a c1905 AC motor. The components are generally in excellent condition and the plant is being restored to operation.



Proof drawing of the bronze Marker

PLAQUING CEREMONY PROGRAM



URRBRAE HOUSE
University of Adelaide – Waite Campus
Glen Osmond, SA 5064

Opening of the 1895 Linde Refrigeration Plant, Wednesday 17 April 1996

8.58am to 9.00am	Introduction of AIRAH National President, Convenor of 1996 Federal AIRAH Conference, Mr Syd Foster
9.00am to 9.05am	Official Opening of 1996 Federal AIRAH Conference, AIRAH National President, Mr Ian Loney
9.05am to 9.15am	Welcome to Urrbrae House, Dean of Agricultural Science, Prof Malcolm Oades
9.15am to 9.30am	Report/paper on the restoration, RARE committee, Mr Ray White
9.30am to 9.35am	The IEAust Plaquing Awards Programme, Chairman of SA Engineering Heritage branch committee, Mr Deane Kemp
9.35am to 9.38am	Unveiling of heritage plaque, President of SA Division of the Institution of Engineers, Australia, Mr Craig Parsonage
9.38am to 9.40am	Acceptance of plaque, Dean of Agricultural Science, Prof Malcolm Oades
9.40am to 9.50am	Photos
10.00am to 11.00am	Inspection by delegates to the 1996 AIRAH conference, followed by members of IEAust, of the refrigeration plant, Urrbrae House and grounds
10.00am to 11.00am	Morning tea while inspection proceeds

Welcome Address

Professor J Malcolm Oades, Acting Director, Waite Agricultural Research Institute

Members of the Australian Institute of Refrigeration, Air Conditioning and Heating; members of the Institution of Engineers, Australia; Ladies and Gentlemen. Welcome to the Waite Campus of the University of Adelaide and to Peter Waite's former residence, Urrbrae House.

Peter Waite, pastoralist, businessman and public benefactor, in 1913 wrote a letter to the Premier of South Australia. In it he referred to the State's impressive past achievements in agriculture and said, "We have now reached a point when it behoves us to call science to our aid to a greater extent than hitherto has been done, otherwise we cannot hope to keep in the forefront ..."

To help the State deal with the future competition for its markets that he foresaw, he offered a portion of his Urrbrae estate to the University of Adelaide for the purposes of research and teaching for the "better development of the natural resources of the land by means of agriculture and husbandry ..."

After his death in 1922, his gift led to the foundation of the Waite Agricultural Research Institute in 1924. Urrbrae House and the adjoining coachhouse and stables housed the Institute's first offices and laboratories until purpose-built laboratories were completed in 1930.

Peter Waite was a remarkable man. Having trained as an ironmonger in his native Scotland, he came to South Australia in 1859 to his brother James' station near Terowie. Three years later he joined in partnership with Thomas Elder in the purchase of adjacent land. Another year later his brother died in an accident, upon which he leased James' property. Three years of drought followed. Far from being discouraged by the harsh blow to his enterprise, he set about improving the properties with permanent water and fences, practised pasture improvement and improved the breed of his flocks. From then on his business flourished.

In 1874 Peter Waite bought the Urrbrae property and moved from Paratoo in the arid north of the State. About ten years later he decided to demolish the old house and to replace it with a comfortable residence which was to be appropriate for the climate and was to have all the latest improvements. The new house, Urrbrae House as we see it today, was finished in 1891. Son James, who was in England studying engineering at the time, may have been an influence when his father decided to install electric lighting and a refrigeration plant. By 1895 electric lighting and refrigeration were no longer a novelty in commercial premises like breweries and flour mills but they were novelties in a private dwelling.

A report by architect David Gilbert in 1991 focused attention on historical aspects of Urrbrae House, including the derelict cold rooms and refrigeration plant. The then Dean of the Faculty, Harold Woolhouse, saw an opportunity to benefit the University by including the historical installation in a community outreach plan. He asked the Curator of Urrbrae House, Yvonne Routledge to arrange the restoration.

Initial publicity drew the support of Ray White, of White Refrigeration Pty Ltd, an alumni of the University of Adelaide. There is a malicious rumour going about that the opportunity to sniff vintage ammonia immediately got Ray hooked on the project. On behalf of the University, I thank him for his dedication to the task. Without his organisational and material help the restoration could not have been done. I also wish to thank the remaining sponsors who have assisted with the work – a list of sponsors can be seen in the display.

The restoration of this, Australia's oldest original refrigeration installation, now forms a part of the University's community outreach resources, a vital activity to foster good public relations. Together with the other facilities of the Campus' historic precinct it will be a vehicle for informing the public about the Faculty's courses and research activities. By this means, Peter Waite's vision, which I quoted at the beginning of my address, will continue to be served – for we need more than ever "to call science to our aid" in dealing with future food production and environmental integrity.

I now have great pleasure in declaring the restored Urrbrae House Cold Rooms open.

Report on the Restoration

Ray White, RARE Committee

Welcome AIRAH members, Engineers, Professor Malcolm Oades and members of the Agricultural Science Faculty, friends of Urrbrae House, friends of ammonia industrial refrigeration and friends of old technology. A special welcome to Marion Wells, the granddaughter of Peter Waite.

Well, we did it. As every contractor can appreciate, we had a year to plan and do the work and we finished yesterday, at midnight.

Thank you for coming to this historic occasion celebrating the recommissioning of the oldest working refrigeration plant in Australia. This old plant was installed 100 years ago in 1895.

Background

There was no electricity and hence no welding, no radio, no TV, no cars, no aeroplanes, no wrist watches. Electric motors were rare but horses and steam engines were common. Ice was imported to Sydney and Melbourne from the Great Lakes in USA.

A few refrigeration plants existed but they were very clumsy. Absorption machines took up a lot of space and the cold air compressors consumed a lot of power. There was a lot of difficulty sealing the shafts in the vapour compression machines as the early refrigerants were volatile and corrosive — ether, methyl chloride, sulphurous acid and ammonia. Leakage was a constant problem. I draw your attention to the large stuffing box on the compressor downstairs.

Carl Linde, along with Otto Diesel was a student of Clausius in the new science of “thermo-dynamics”. In the 1870s he analysed the refrigeration systems of the day and realised they all had some shortcomings.

As an academic, Dr Carl Linde knew that ammonia has a considerable advantage over other fluids because it approaches the ideal Carnot efficiency. This is one of the reasons why it is used as the main industrial refrigerant to this day. Another advantage which was pertinent to the era was the pressures required for -15°C evaporation and 30°C condensing of 20 psig and 70 psig were similar to the pressures in steam engines. After all, refrigeration is only a steam plant running backwards.

A successful compressor using ammonia was developed by Linde in 1876. It was the first mass-produced refrigeration compressor. The machine downstairs was number 287 out of an eventual production run of approximately 1500. The number 287 was written on the inside of many of the flanges and was only discovered during the restoration.

Linde established the world's leading refrigeration company with licensed manufacturers in many countries, including Germany, Britain and the USA. The British company was eventually sold to Britain as part of war reparations after World War I.

Linde received a patent for liquefying air in 1895, the year this compressor was built.

When Peter Waite chose a refrigeration plant for his new house, refrigeration was a novelty, industrially as well as domestically. Even until the 1950s, produce in the house was kept cold by block ice made in a central factory and distributed by vendors.

In a refrigeration catalogue dated around 1910, put out by Wildridge and Sinclair, this plant is mentioned and was the only one supplied for domestic use. Most early plants were used for butchers shops in the booming town of Broken Hill which had a population of 30 000, and was where we found the old motor.

Before computers and CAD, the draftsmen of the day drew with pen and ink on linen. Sometimes it was also coloured like the original “plant arrangement” drawing of 1895 by Wildridge and Sinclair. Lithographs were also common such as the illustration of a Linde ammonia compressor driven by a steam engine published in *The Engineer*, 20 January 1899. There is also a cross sectional drawing of the piston, valves and stuffing box assembly. I draw your attention to these and other drawings and photos on the display boards. Please inspect them before making your visit to the plant in the basement.

The single cylinder compressor in the plant below has a bore of 5 inches and a stroke of 5 inches and runs at 135 rpm. The ammonia is compressed in two stages. The compressor has a capacity of 1.7 tonR or 6.0 kW and absorbs 2.1 BkW from the 6 kW 980 rpm electric motor while operating at the standard conditions of -15°C suction and 30°C condensing. Note there is no water jacketing of the cylinder and there is no intercooling between the two compression stages.

Restoration Work

Work began with the complete disassembly of the equipment. Only the evaporator was left untouched. Each component was brushed and cleaned with solvent. External steel and cast iron surfaces were either grit blasted or wire brushed back to bare metal. The copper and brass surfaces were polished.

Much of the equipment was still in good working order but, after 100 years, certain items had to be replaced. All the rubber-like gaskets had perished and were replaced with 1.6 mm thick Klingerite gaskets. The piston rod rope-like stuffing had also degenerated and was repacked with Teflon packing. Samples of the removed materials have been kept and all were still impregnated with the smell of ammonia.

The condenser coil had rusted through and could not be repaired. A completely new coil was constructed. The main cast iron structural casing which contains the condenser was cracked from top to bottom in one corner. This crack was ground out and filled with a modern steel-filled epoxy putty.

The piston, piston bore and piston rings were left “as found” because they were in excellent condition. Unfortunately the piston rod was badly scored. It was ground back and hard-chromed to its original diameter. The crankshaft was built up by metal spraying at the driving flywheel end.

The original 32V DC motor had been removed and lost. An 8 hp motor and mechanical starter that drove a similar Linde ammonia compressor of equivalent age were located in a butcher’s shop in Broken Hill. They were disassembled, cleaned and tested at Pope Electric Motor’s test facility.

After reassembly, the plant was primed and brush painted with an enamel blue/grey colour typical of the era. Finally it was pressure tested and evacuated prior to receiving a fresh charge of ammonia.

Throughout the overhaul reference was made to drawings, texts and catalogues of the era as well as the photos taken prior to dismantling. The original plant arrangement drawn in ink on linen was also a useful guide. Photographic records detail each separate component before, during and after overhaul. The assembled plant was photographed before and after restoration.

The problems we experienced during commissioning consisted of repairing water leaks in the main cover plate and stretching of the leather belt.

Thanks

Thanks to Mac Adarnson who realised Urrbrae House had a treasure and persisted in contacting people until others recognised it too.

Thanks also to the many who have given their time, expertise and money. Although they are recognised in one of the posters I should like to thank them for their contribution which made this project possible within a small budget.

Inspection

Finally we invite you to inspect the plant and enjoy Urrbrae House. Because the machinery is in a small room in a basement we request you visit in groups of five for five minutes at a time. Could members of the Institution of Engineers kindly allow AIRAH members to precede them as they have to catch buses back to their conference.

Please be careful during your inspection. For example there is a protruding key on the small flywheel near the entrance door, a flat unguarded leather belt, a cast iron liquid receiver, no relief valve, no sight glass and no DLI inspectors.

Thank you for coming and feel free to ask questions of the committee members who will be beside the machine downstairs. Thank you.

Acceptance of the Plaque

Professor J Malcolm Oades

Restoration committee member Dr John Pickles of the University's Mechanical Engineering Department, a member of the Engineering Heritage Branch of the Institution of Engineers Australia, was instrumental in arranging the accreditation of the Urrbrae House Refrigeration Plant and Cold Rooms as an engineering heritage site.

Thank you John.

We are proud that the Institution has agreed to award the site one of its engineering heritage markers. On behalf of the University of Adelaide I thank the Institution of Engineers for its recognition of the Urrbrae House refrigeration installation as a heritage site and it gives me great pleasure to accept the plaque.

TECHNICAL DATA	
COMPRESSOR	
Make	Linde
Type	Single cylinder, 2 stage no intercooling
Valves	Poppet
Bore	5 inch (125 mm)
Stroke	5 inch (125 mm)
Swept Volume	7.7 ft ³ /min (3.6 L/s)
Flywheel Diameter	41.5 inch (1055 mm)
Speed	135 rev/min
Capacity	1.7 tonR (6.0 kWR) at -15°C/30°C
Absorbed Power	2.8 BHP (2.1 BkW) at -15°C/30°C
MOTOR	
Make	General Electric
Type	Horizontal induction
Speed	980 rev/min
Power	8 BHP (6 BkW)
Pulley O.D.	5.7 inch (145 mm)
Starter	Mechanical star delta, immersed in oil
CONDENSER	
Type	One oval steel coil, under water
Pipe O.D.	1.5 inch (38 mm)
No. of Turns	22
Total Length	86 ft (26.4 m)
Surface Area	34 ft ² (3.1 m ²)
EVAPORATOR	
Type	Three oval steel coils
Pipe O.D.	1.5 inch (38 mm)
No. of Turns	14 per coil
Total Length	745 ft (227 m)
Surface Area	292 ft ² (27 m ²)
Control	One only hand expansion valve
LIQUID RECEIVER	
Type	Cast iron pot
Volume	0.25 ft ³ (8 L)



1. Marqu e erected in the grounds of Urrbrae House
 2. Malcolm Oades addressing conference delegates and guests
 3. Craig Parsonage, SA Division President, Institution of Engineers, unveiling the plaque
 4. Professor Malcolm Oades, Acting Director, Waite Agricultural Research Institute
 5. Ray White, RARE Committee, describing the restoration project
- [Photos: John Pickles]

Ceremony Brochure

STATEMENT OF SIGNIFICANCE URRBRAE HOUSE REFRIGERATION PLANT AND COLD ROOMS

The refrigeration system and associated cold rooms in the basement of Urrbrae House on the Waite Campus of the University of Adelaide is the earliest known application in Australia of the then current commercial refrigeration practice for domestic use.

The design and installation of this innovative system was contracted by pastoralist Peter Waite to the firm of Wildridge & Sinclair of Sydney. It was installed in 1895 and, according to an early catalogue, it was Wildridge & Sinclair's first domestic installation. The firm has only recently (1989) gone out of business.

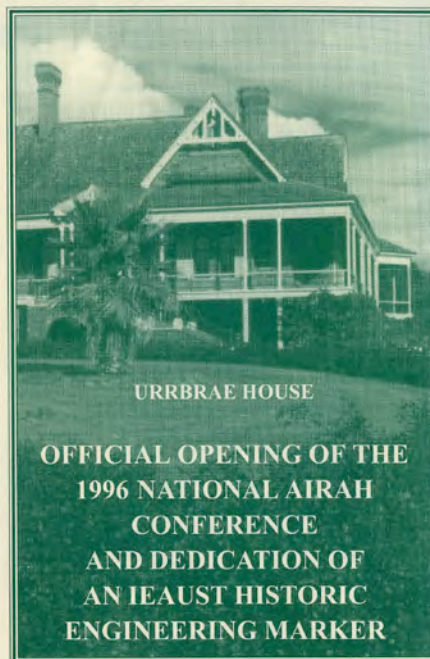
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The design of the compressor reflects established steam engine technology of the time. The piston is double acting, driven by a crankshaft running at 120 rpm and the operating pressures of 20 psig and 170 psig were similar to those used in contemporary steam practice.

The compressor provides an interesting instance of the era of transition from steam to electric power. The frame and crankshaft have provision for the mounting of a steam cylinder to power the machine but, in this installation, an electric motor was used.

The plant appears to be unchanged since its original installation: the original colour-washed layout drawing survives. All the equipment and components are original, apart from the 32V DC electric drive motor which is missing. This is being replaced with a c1905 AC motor. The components are generally in excellent condition and the plant is being restored to operation.

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URRBRAE HOUSE

OFFICIAL OPENING OF THE 1996 NATIONAL AIRAH CONFERENCE AND DEDICATION OF AN IEAUST HISTORIC ENGINEERING MARKER



The Australian Institute of Refrigeration,
Air Conditioning and Heating Inc

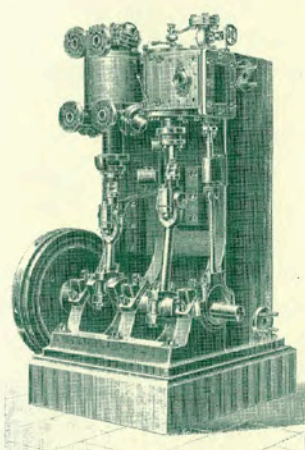
ADELAIDE
17 APRIL 1996



The Institution
of Engineers,
Australia



The Institution of Engineers Australia and the University of Adelaide are pleased to be invited to commemorate the earliest example of domestic refrigeration in Australia during the opening of the 1996 National AIRAH Conference



THE AUSTRALIAN HISTORIC ENGINEERING PLAQUING PROGRAM

This program has been operated by the Institution of Engineers Australia since 1984 as a means of attracting public attention to historic engineering objects and sites and increasing awareness of the significant contribution made by engineers to the development of Australia and the welfare of its people.

The Urrbrae House refrigeration installation is the seventh engineering works in South Australia to be honoured with an Historic Engineering Marker.

PROGRAM 17 APRIL 1996

Official Opening of 1996 National AIRAH Conference
Mr Ian Loney, AIRAH National President

Welcome to Urrbrae House
Prof Malcolm Oades, Dean of Agricultural Science

Restoration Report
Mr Ray White, RARE Committee

The IEAust Plaquing Program
Mr Deane Kemp, Chairman SA Engineering Heritage Branch

Unveiling of Historic Engineering Marker
Mr Craig Parsonage, President SA Division IEAust

Acceptance of Historic Engineering Marker
Prof Malcolm Oades, Dean of Agricultural Science

Morning tea and inspection of plant

This historic refrigeration plant has been refurbished by the combined efforts of the RARE (Restoration of Ancient Refrigeration Equipment) Committee, local companies and refrigeration engineers, and volunteers. Their dedication and enthusiasm has helped preserve this unique example of our engineering heritage.

Sponsorship of the conference opening and dedication ceremony has been proudly provided by the Refrigeration and Air Conditioning Contractors Association



Ceremony Invitation

3 April 1996



SOUTH
AUSTRALIAN
DIVISION

Dear

HISTORIC ENGINEERING MARKER:

REFRIGERATION PLANT AND COLD ROOMS AT URRBRAE HOUSE

The refrigeration plant and cold rooms at Urrbrae House are the earliest known application in Australia of commercial refrigeration plant for domestic use.

The plant was installed in 1895 and has recently been refurbished by the combined efforts of the RARE (Restoration of Ancient Refrigeration Equipment) Committee, local companies and refrigeration engineers, and volunteers.

Because of its engineering heritage significance, The Institution of Engineers Australia, in association with the University of Adelaide, will commemorate the installation with an Historic Engineering Marker. The marker will be unveiled by the President of the South Australian Division of The Institution during the opening ceremony of the national Australian Institute of Refrigeration Airconditioning and Heating conference on Wednesday 17 April.

We would be pleased if you could join us for the ceremony and afterwards for morning tea. The ceremony will take place in a marquee in the grounds of Urrbrae House which is part of the Waite Campus of the University of Adelaide. You can enter the grounds of Waite Road (Gate 3) where there is limited parking or from Fullarton Road (the car park at the end of Walter Young Avenue).

The program commences at 8:55am and will conclude about 10:00am. There will also be an opportunity to inspect the plant and cold rooms during the morning tea which follows.

Please reply to Brooke or Michelle at The Institution office on 267 1783 by Friday 12 April.

Yours sincerely

Deane Kemp
Chairman
Engineering Heritage Branch

Engineering House, 11 Bagot Street, North Adelaide, S.A. 5006 Phone (08) 267 1783 Fax (08) 239 0932

Media Release and Articles



THE UNIVERSITY
OF ADELAIDE

News Release

for: Wednesday, April 17, 1996

Australia's oldest fridge gets new lease on life

More than 100 years after it was installed Australia's oldest domestic fridge has been revived.

The three-room refrigeration plant was installed at Urrbrae House (now part of the University of Adelaide's Waite Campus) in 1895 to chill food for the family of South Australian pastoralist Peter Waite.

Born in an era of transition from steam engine technology to electricity, the refrigeration plant is huge by today's domestic standards.

It has been unused for most of the century. Over the past two years the plant has been dismantled, refurbished and rebuilt to its original working condition by volunteers as part of the restoration of Urrbrae House.

The hands-on restoration of the refrigeration plant was instigated and coordinated by a member of the Restoration of Ancient Refrigeration Equipment (RARE) Committee, University of Adelaide graduate Mr Ray White of White Refrigeration.

On Wednesday, April 17 the revived refrigeration plant will be recommissioned at the opening of the 1996 conference of the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH).

The importance of the refrigeration plant has been recognised by the Institution of Engineers, Australia (IEAust). At the opening IEAust will unveil an Historic Marker Plaque, signifying the plant's contribution to the engineering history of Australia.

**The opening of the refrigeration plant is 8.50am Wednesday, April 17
at Urrbrae House, University of Adelaide (Waite Campus).**

MEDIA CONTACT:

- Dr John Pickles, IEAust Engineering Heritage Branch: (08) 303-5449 wk, (08) 331-9111 hm.
- Ms Yvonne Routledge, Urrbrae House Curator: (08) 303-7425 wk, (08) 338-2739 hm.

The University of Adelaide
South Australia 5005
Telephone: (08) 303 5174
Facsimile: (08) 223 6437
A/H: (015) 396 478 Mobile

Media & Public Relations Office:

Rm G07 Mitchell Building
North Terrace Adelaide

Historic fridge plant unveiled at Waite

More than 100 years after it was installed Australia's oldest domestic fridge has been given a new lease on life.

The three-room refrigeration plant was installed at Urrbrae House (now part of the University of Adelaide's Waite Campus) in 1895. Over the past two years the plant has been dismantled, refurbished and rebuilt to its original working condition as part of the restoration of Urrbrae House.

The refrigeration plant is the oldest of its kind known to exist in Australia and is one of the oldest in the world. Born in an era of transition from steam engine technology to electricity, the plant contained a single cylinder ammonia compressor, huge by today's domestic standards, driven by a 32-volt direct current motor and a small fan to circulate the chilled air.

South Australian pastoralist Peter Waite contracted the refrigeration plant, which was designed to chill food for the Waite family. It is believed the plant was not used for long, however, because of technical problems.

For almost 100 years the fridge remained virtually untouched. The oil congealed, sticking together parts that once moved, and the condenser coil rusted away after sitting in a pool of water for almost a century. But a few years ago the Institution of Engineers, Australia (IEAust) was notified of the plant's possible historical value.

"It's unique in Australia," said Dr John Pickles, who is a senior lecturer with the University of Adelaide's Department of Mechanical Engineering and a member of the Waite's Restoration of Ancient Refrigeration Equipment (RARE) Committee.

"It's the oldest domestic fridge in Australia, but it's also a very unusual design — more like a scaled-down industrial refrigeration plant than a domestic one. I've never come across anything quite like that size for domestic use," he said.

"I don't believe it was ever a great success, because the machinery didn't show signs of having been used extensively. However, the refrigeration plant has a significant

historic value."

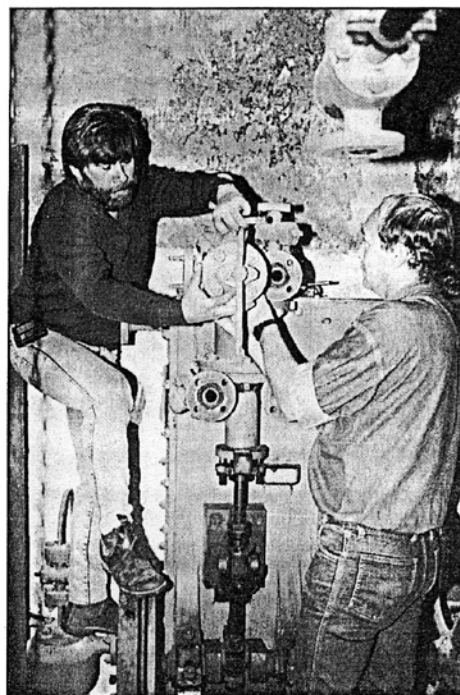
Dr Pickles said the hands-on restoration of the refrigeration plant had been instigated and coordinated by another RARE committee member, University of Adelaide graduate Mr Ray White of White Refrigeration.

Much of the work — dismantling, cleaning, replacing, and rebuilding — had been volunteered by White Refrigeration, as well as other South Australian companies, Alberton Electrical Services, Ideal Steam Cleaners, Metallizing Services, Peter Moore Engineering, Pope Electric Motors, Protec, and Tynbell.

The restored 100-year-old refrigeration plant was finally unveiled on Wednesday, 17 April during the opening of the national Australian Institute of Refrigeration, Air Conditioning and Heating conference at Urrbrae House.

A special plaque from IEAust was also unveiled, signifying that the plant is one of the most important historical engineering achievements in Australia.

—David Ellis



Dismantling the compressor — photo courtesy of White Refrigeration

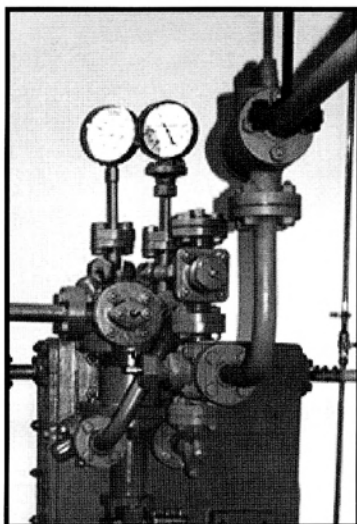
"Campus News", *Adelaidean*, University of Adelaide newsletter, 22 April 1996, page 6

HISTORIC MARKER FOR REFRIGERATION PLANT

South Australia's seventh Historic Engineering Marker was awarded to the refrigeration plant at Urrbrae House.

Urrbrae House is the former family home of pastoral pioneer Peter Waite, who arrived in Australia in 1859 joining his brother on his property near Terowie in South Australia. In the ensuing years his fortunes prospered and he eventually owned extensive interests in pastoral properties.

In 1874 Peter Waite purchased "Urrbrae". Fifteen years after his purchase, Waite decided to rebuild the existing home and, by the end of 1889, a two storey mansion of 35 rooms had been erected. The new home reflected his innovative outlook and featured such novelties



as a tiled roof and a 32 volt DC lighting system supplied from a large bank of batteries.

The refrigeration plant was installed in 1895 by Wildridge and Sinclair of Pitt Street Sydney, using a compressor built by the Linde British Refrigeration Company of London. Dr Carl Linde had patented a new compression process using liquid anhydrous ammonia in 1873, and in 1876 produced the first commercial machine operating on this system. The unit at Urrbrae House is the first adaptation of commercial refrigeration technology for domestic use in Australia (although Waite's house, with its extensive rooms and facilities, including a ballroom and musicians' gallery, is hardly typical of South Australian residences).

Engineering Heritage Australia newsletter, No 7, September 1997, page 5

AIRAH Conference Promotion



AIRAH Conference and Exhibition brochure

Front Cover

The drawing on the front cover is a copy of the hand-tinted original, laying out the oldest known existing refrigeration plant in Australia. One hundred years ago in 1895, Wildridge and Sinclair used it to install an ammonia refrigeration plant in Urrbrae House for Peter Waite. A most unusual fan supplied the cold air through an overhead wooden duct to three wood-lined cold rooms. The compressor was built by Linde of England. It is a vertical single cylinder, double acting machine with spring closed poppet valves, stuffing box and cross head. The open crankshaft was driven at 120rpm by an open flat leather belt from a 32 volt DC motor.

The equipment and cold rooms are in excellent condition. The ammonia refrigeration plant is being restored to its original working condition by a team of volunteers and will be recommissioned in early 1996.

The photograph on the front cover is Urrbrae House. You can inspect the two story mansion of thirty-five rooms and its historic refrigeration plant during the Adelaide Conference.

Photograph: Waite Agricultural Research Institute, University of Adelaide

Historic refrigeration plant



A VISIT to a one hundred-year-old domestic refrigeration plant will be available next year at an international conference on air conditioning and refrigeration in Adelaide.

The ammonia refrigeration plant, the oldest known existing plant in Australia, is in excellent condition.

It is being restored to its original working condition by a team of volunteers, and will be recommissioned early in 1996.

Situated in a 35-room Adelaide mansion, Urrbrae House, the refrigeration plant consists of three wood-lined rooms and a compressor built by Linde of England.

It was installed for the owner, Peter Waite, in 1895.

The compressor is driven by an open flat leather belt from a 32 volt DC motor, and cold air is blown by a fan through wooden over-

head ducts.

Delegates to the International Air Conditioning and Refrigeration Conference, from 17-20 April, will be able to inspect Urrbrae House (pictured above), including its refrigeration plant, during the conference.

The conference is organised annually by the Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH).

Accompanied by a trade exhibition, it will be held at the Adelaide Convention Centre.

The conference is Australia's premier exchange of information on research, technology, commerce, products and issues in the refrigeration, air conditioning, heating, ventilation and building services sector.

Further information
AIRAH
(03) 328 2399

22 ATM ■ ASCENT TECHNOLOGY MAGAZINE - NOVEMBER 1995



The Australian Institute of Refrigeration
Air Conditioning and Heating (Inc.)

International Air Conditioning and Refrigeration Conference and Exhibition

AUSTRALIA
Adelaide Convention Centre
South Australia
17 - 20 April, 1996

Early Bird Registration Form

The restoration of the refrigeration equipment and cold rooms was featured in the promotion of the 1996 AIRAH conference in Adelaide through brochures and articles

AIRAH S.A. DIVISION NEWSLETTER

AUSTRALIA'S OLDEST FRIDGE TO BE REVIVED

Restoration of the ancient refrigeration plant at Urrbrae House has begun. Forty people gathered at the official launch on Saturday 3 September. After introductory talks by Prof. Harold Woolhouse, Director of Urrbrae House and Ray White, coordinator of the refrigeration restoration, the compressor head was removed so that all could view the heart of the refrigeration plant. Also on display were the original technical drawings, on linen.

First the uniqueness of the compressor was explained. To put it into historical context the first freezing works in the world were established at Darling Harbour in 1861. Then in 1874 the New South Wales Fresh Food and Ice Co. was set up using ammonia compression machinery. The ammonia compression cycle machinery used for refrigeration at Urrbrae House was only developed as a successful industrial viability by Linde in Germany in 1876. Linde went on to become one of the world's leading refrigeration machinery manufacturers.

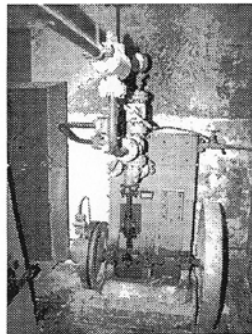
Adelaide first saw refrigeration in 1878 when the Adelaide Ice Works of Anderson & Co. was set up using a plant based on anhydrous sulphurous acid refrigerant. Refrigeration was still very much an industrial process when Peter Waite, the innovative pastoralist who built Urrbrae House, applied refrigeration to domestic needs in 1895. Now after 100 years this refrigeration plant is one of the few survivors of its era and probably the oldest in Australia.

With the cylinder head removed the bore was found to be in near perfect

condition belying its age. The rounded shape of the piston was visible and, with some effort the piston could still be turned on its crank. Some interesting features of the plant were highlighted at this time.

The compressor is double acting with poppet valves at the inlet and outlet. The piston head is rounded in shape for greater strength and a smaller clearance volume. The valve faces are shaped similarly for the same reason.

The whole system was designed for oil free operation. The connecting rod and crank are exposed and there is no oil separator. The evaporation coils are huge to ensure that no liquid carries over into the compressor.



The compressor prior to restoration



Prof. Dr. Carl V. Linde



Ray white showing symptoms of "Ammonia Addiction"

An interesting detail is the construction of the stuffing box which is made of two separate layers of packing separated by a space. This space is internally connected to the suction line. Any ammonia leaked through the inner packing is carried back to suction. The outer packing is more efficient because it is exposed to the smaller pressure difference between the suction pressure and atmospheric pressure.

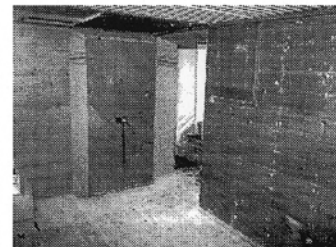
Obviously some oil was needed to lubricate the gland packing. There is still some question as to how this was achieved but all will be revealed as the disassembly progresses.

The original design had a position allocated for a driving piston powered by steam. The actual installation was run by a 32 Volt DC electric motor coupled to the crankshaft by a flat belt extending the full length of the room. This motor also drove a small fan of a most unusual design which

circulated the air through the cold rooms. The original motor is missing but fortunately an electric motor of the appropriate era has been located and will be installed as part of the renewed system. The machinery, kept separate from the main chilling area, serviced three main rooms. Just how cold it was able to keep them is an interesting question.

All of the rooms are completely wood panelled and the walls are about 200mm thick. The ceiling space was specially designed to accommodate the cumbersome supply and return ducts. All the doors had angled frames to obtain positive pressure but sealing was achieved using blankets!

The plant and associated cold rooms will be restored to their original working condition but the plant will only be run for demonstration purposes. Work should be finished by late 1995-early 1996 in time for the AIRAH National Conference to be held in Adelaide that year.



One of the timber coolrooms

Historic refrigeration plant to be restored

by Bob Jackson

Australia was the first country in the world to fully exploit commercial refrigeration by exporting frozen meat to England in a refrigerated ship in 1879.

About 20 years before this undertaking a freezing works, reputed to be also a world first, had been established at Sydney's Darling Harbor.

It is therefore not surprising that an Australian house, Urrbrae House in Adelaide, was one of the world's first houses to install its own refrigeration plant. The plant was installed by Peter Waite, a pastoralist and businessman, in 1895.

Although the plant has been unused for many years, much of the original installation is still there and even the original technical drawings on linen survive.

The plant is being restored by a voluntary committee headed by ammonia refrigeration specialist Ray White for the present owner, the Waite Agricultural Research Institute of Adelaide University. The team of volunteers hope to have the plant recommissioned in time for the International Airconditioning and Refrigeration Conference, to be held at the Adelaide Convention Centre next April.

The ammonia compression cycle technology used in the refrigeration plant was developed by Dr Karl Linde in Germany in 1876. The plant used at Urrbrae House was built by the Linde British Refrigeration Company in London and was installed in the basement of the house by the Sydney engineering firm of Wildridge and Sinclair.

The compressor is a vertical unit

about 2m high with a single double acting cylinder with spring-closed poppet valves. The compressor was driven by a 32V two wire DC electric motor. The original electric motor has

culated. The evaporator consists of a large array of wrought iron tubes contained in an air plenum. Air was cooled by being drawn over the evaporator tubes by a fan. The fan discharged into a wooden duct which carried the cooled air to three wood-lined cold rooms.

The air flow to the three rooms could be controlled by opening and closing several hinged flaps and sliding shutters, both into the rooms and within the ductwork itself, the latter being operated by pullwires terminating in brass acorns. The first room, closest to the evaporator plenum, was used for meat storage. The second room has a false ceiling made of corrugated iron, and the cold air was passed through the ceiling space to prevent chill burn to fruit and vegetables stored there. The third room was a general purpose cold store, the chilled air being passed directly through the room. The discharge air from the rooms was ducted back to the evaporator plenum. A small hinged flap in the wall of the second room, leading to a vertical duct, indi-



Historic Urrbrae House in Adelaide has one of the world's oldest domestic refrigeration plants. The plant is being restored by a voluntary committee.

been removed, but a replacement motor of similar design has been located. The piston rod is driven by a crankshaft and crosshead running at 120rpm.

The condenser is integral with the vertical compressor bed plate which consists of a number of iron coils to carry the refrigerant. The coils are contained in a cast iron chamber through which cooling water was cir-

cates that cool air may have been diverted to the upper rooms of the house in summer.

The head, jambs and threshold on each coldroom door are angled and lined with woollen blankets for sealing. Cold room temperature was monitored by a thermometer set in each cold room door and the temperature was regulated by manual adjustment of the regulating valve. □

Historic Marker for Refrigeration Plant

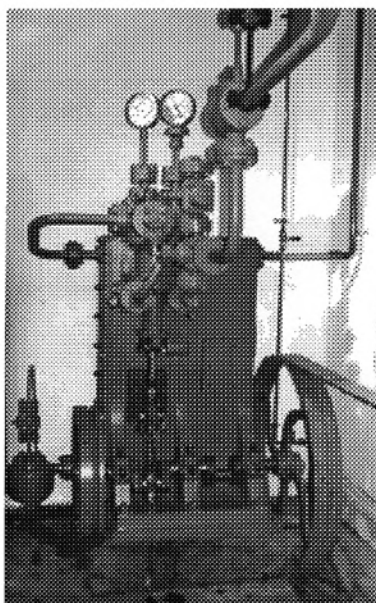
South Australia's seventh Historic Engineering Marker was awarded to the refrigeration plant at Urrbrae House during a ceremony to open the 1996 National AIRAH Conference in Adelaide. The marker was presented by SA Division President, Craig Parsonage, and accepted by Professor Malcolm Oades, Dean of Agricultural Science.

Now part of the University of Adelaide's Waite Campus, Urrbrae House is the former family home of pastoral pioneer Peter Waite. Born in Scotland, Waite arrived in Melbourne in 1859 and, shortly after, joined his brother James on his property near Terowie in South Australia. In the ensuing years his fortunes prospered and he eventually owned extensive interests in pastoral properties.

In 1874 Peter Waite's business interests brought him to Adelaide and he purchased "Urrbrae". Fifteen years after his purchase, Waite decided to rebuild the existing home and, by the end of 1889, a two storey mansion of thirty-five rooms had been erected. The new home reflected his innovative outlook and featured such novelties as a tiled roof and a 32 volt DC lighting system supplied from a large bank of batteries. The surviving battery house contains a plinth for a generator which seems to have been driven by a portable steam engine located outside the building, with the flat belt passing through a steel-doored slit in the wall. The steam engine was later replaced with an oil engine.

The refrigeration plant was installed in 1895 by Wildridge and Sinclair of Pitt Street Sydney, using a compressor built by the Linde British Refrigeration Company of London. Dr Carl Linde had patented a new compression process using liquid anhydrous ammonia in 1873, and in 1876 produced the first commercial machine operating on this system. The unit at Urrbrae House is the first adaptation of commercial refrigeration technology for domestic use in Australia (although Waite's house, with its extensive rooms and facilities, including a ballroom and musicians' gallery, is hardly typical of South Australian residences).

The Urrbrae House compressor is a vertical, single cylinder, double-acting unit with spring closed poppet valves. The piston rod is driven by a crankshaft and crosshead arrangement running at 120 rpm. The original hand-tinted layout drawing, which has survived in the Waite archives, shows a steam cylinder adjacent to the compressor cylinder, both coupled to a common crankshaft. However, although there is a second crank on the shaft and mountings for a steam cylinder on the cast iron bed, none was supplied. Waite opted instead for an electric motor, supplied from the house's 32 volt two-wire DC system, driving the crankshaft by means of a flat belt.



The ammonia condenser is integral with the vertical compressor bedplate, consisting of a number of wrought iron coils carrying the refrigerant and contained in a cast iron chamber through which cooling water is circulated. The evaporator consists of a single serpentine wrought iron tube located in an air plenum. Air is cooled by being drawn over the evaporator tube by a fan of unusual (and probably inadequate) design, driven from the motor shaft via a rope belt and layshaft.

The fan discharges into a wooden duct which conveys the cooled air to three wood-lined and charcoal insulated cold-rooms. The air flow to the three

rooms can be controlled by opening and closing a number of hinged flaps and sliding shutters, both into the rooms and within the ductwork itself, the latter being operated by pull-wires terminating in brass acorns.

The first room, closest to the evaporator plenum, was used for meat storage. It was possible to divert the full flow from the fan into this room to provide rapid chilling of meat. The second room has a false ceiling of corrugated iron, the cold air passing through the ceiling space rather than directly through the room, probably to protect fruit and vegetables from direct contact with moving chilled air. The third room was a general purpose cold store. The discharge air from the rooms is ducted back to the evaporator plenum. A small hinged flap in the wall of the second room, leading to a vertical duct, seems to indicate that it may have been possible to divert cool air to the upper rooms of the house in summer.

The head, jambs and threshold of the 200mm thick cold-room doors are angled and lined with blankets to ensure a good seal. Control of cold-room temperature is by manual adjustment of a regulating valve upstream of the evaporator with temperature being monitored by a thermometer inserted in a brass pocket in each of the cold-room doors.

A group of enthusiastic volunteers formed the RARE Committee (RARE being an acronym for Restoration of Ancient Refrigeration Equipment). Assisted by local companies and refrigeration engineers, they have restored the plant to its former glory. Ray White, who led the team's efforts, said that many of the construction techniques could never be matched today. Hand-made cast iron fittings and beautifully-formed condenser coils mean that the compressor will probably last for at least another 100 years.

The original motor has not survived, although its plinth remains. However, by using a list of customers in a Wildridge and Sinclair catalogue of about 1910, the RARE Committee located a General Electric induction motor that used to drive a similar Linde compressor in a butcher's shop in Broken Hill. The 8 hp motor was designed for 40 cycles at 550 volts, and a no load speed of 800 rpm, but was rewound some years ago for present supply conditions.

*Article prepared for monthly newsletter of Engineers Australia
South Australia Division*

Urrbrae House: History and Drawings



Urrbrae House is the former family home of pastoral pioneer Peter Waite. Peter Waite was born near Kircaldy, Fifeshire, Scotland in 1834. As a lad he was apprenticed to an ironmonger in Edinburgh. In 1859 he arrived in Melbourne and shortly after joined his brother James on his property near Terowie in South Australia. In the ensuing years his fortunes prospered so that, in partnership with Sir Thomas Elder, he eventually owned extensive interests in a number of pastoral properties.

Peter Waite was well known for his innovative approach to pastoralism: he demonstrated the advantages of fenced properties, importing 265 tons of fencing wire from England in 1870, and, realising their worth in our arid environment, bred camels and donkeys extensively. In 1874 Peter Waite's business interests brought him to Adelaide and he purchased "Urrbrae".

The original Urrbrae property had been established in 1839 and a single storey house was constructed in 1844.

Fifteen years after his purchase of the property Peter Waite decided to rebuild the old home and by the end of 1889 a two storey mansion of thirty-five rooms had been erected. The new home reflected Peter Waite's innovative outlook, featuring such novelties as a tiled roof and a DC lighting system (possibly 100 volts) supplied from a large bank of lead-acid batteries.

The surviving battery house contains a plinth for a generator which seems to have been driven initially by a portable steam engine located outside the building, with the flat belt passing through a steel-framed slit in the wall. Later the steam engine was replaced with an oil engine.



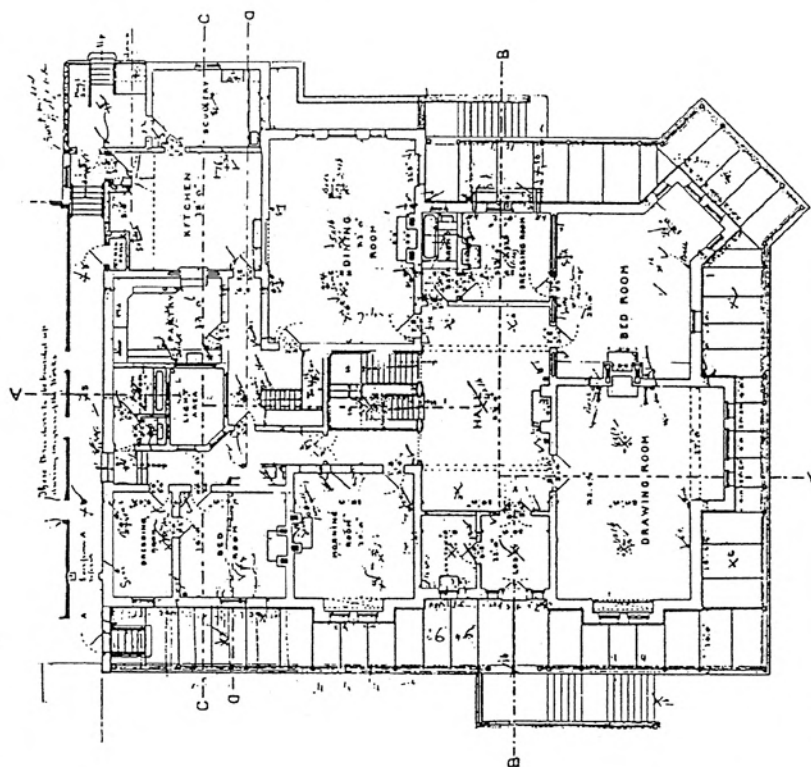
The original Urrbrae House [State Library SA B14454]

DRAWING N°2

RESIDENCE MITCHAM

FOR

PETER WAITE ESQ



SCALE 3/32 INCH

FIRST STOREY

SECOND STOREY

1) J. Morris & Co. Architects
2) J. Morris & Co. Architects

Handwritten notes and signatures.

24/12/90

S-65-1

Architect's drawings, alterations to Urrbrae House, 24 April 1890

Restoration of Ancient Refrigeration Equipment (RARE)

The nomination for the award of an Historic Engineering Marker to the refrigeration plant and cold rooms was made by the Engineering Heritage Branch of the South Australian Division of the Institution of Engineers Australia, with the assistance of the Restoration of Ancient Refrigeration Equipment (RARE) Committee set up by the Waite Agricultural Research Institute of the University of Adelaide.

The members of this committee are:

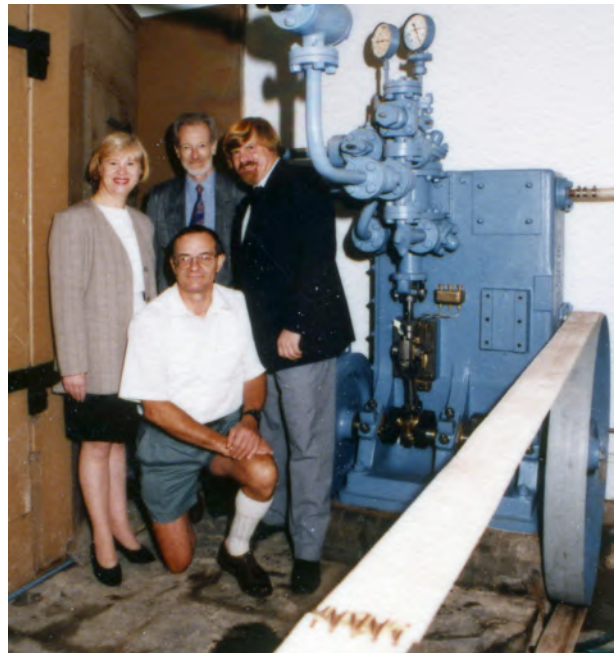
Mr Ray White (Director, White Refrigeration Pty Ltd)

Ms Yvonne Routledge (Curator, Urrbrae House Historical Precinct)

Mr Bernard Arnold (Finance Officer, Faculty of Agricultural & Natural Resource Sciences)

Dr John Pickles (Hon Sec, Engineering Heritage Branch Committee, SA Division, Institution of Engineers Australia)

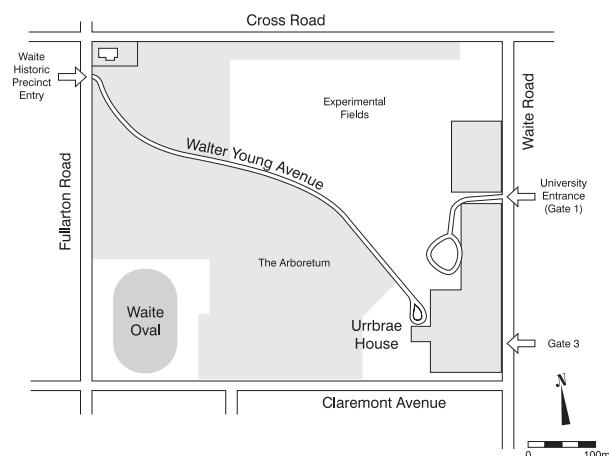
The unveiling ceremony for the Marker was conducted as part of the annual conference of the Australian Institute of Refrigeration, Air conditioning and Heating (AIRAH) on 17 April 1996. The restoration itself had been completed in 1994 and the installation was first opened to the public on 3 September.



The RARE Committee in the Urrbrae House plant room: Yvonne Routledge, John Pickles, Ray White, and Bernard Arnold (kneeling)

LOCATION

The refrigeration plant and cold rooms are located in the basement of Urrbrae House, the centrepiece of the Urrbrae Historical Precinct in the south-eastern corner of the University of Adelaide's Waite campus which is bounded by Fullarton Road, Cross Road, Waite Road and Claremont Avenue. Access to Urrbrae House is via Gate 3 on Waite Road.



Urrbrae House location plan



RARE COMMITTEE (Restoration of Ancient Refrigeration Equipment)

invites you to the launch of the restoration of Australia's oldest domestic refrigeration plant (1895) located at Urrbrae House, the former family home of pastoral pioneer Peter Waite.

The launch will be held at 10.30am on Saturday September 3rd at Urrbrae House which is now part of the Waite campus of the University of Adelaide (enter the Waite Campus from the Fullarton Road entrance and follow the long driveway to Urrbrae house).

Come and view the plant and cold rooms in the cellar of Urrbrae House and see the first step in a project which will lead to this fascinating piece of equipment being restored to working order.

After the viewing morning tea will be served in the dining room of Urrbrae House in front of an open fire.

RSVP Yvonne Routledge by Thursday September 1st

*Invitation to the launch of the restoration,
3 September 1994*



25 August 1994

"THE BIG CHILL"

Australia's oldest fridge gets new lease on life

It's possibly the oldest existing domestic refrigeration plant in Australia and for the group of South Australian refrigeration mechanics planning to restore it, it represents the ultimate challenge.

The Linde refrigeration plant installed at Urrbrae House by Peter Waite in 1895, will be returned to its original working condition as a centenary project, part of the overall restoration of Urrbrae House. The dismantling process will begin on Saturday September 3 with the releasing of the first rusted bolt.

The volunteers will use modern day know how and the construction techniques of a by gone era to bring the refrigeration plant back to life.

The first freezing works in the world were established at Darling Harbour in 1861 but Adelaide didn't get its first refrigeration until 1878 when the Adelaide Ice Works of Anderson & Co was set up using a plant based on anhydrous sulphurous acid refrigerant. When Peter Waite applied a Linde ammonia refrigeration plant to his domestic needs in 1895, refrigeration was still very much an industrial process.

"The refrigeration plant, and the entire house, reflected Peter Waite's enthusiasm with new technology," said the technical coordinator of the restoration project, Mr Ray White.

"Such novelties as domestic refrigeration, a tiled roof and electrical fittings and lights through the building are but some of the features of this truly unique house."

Mr White is a mechanical engineer and Adelaide University graduate whose company designs, manufactures and installs large industrial refrigeration plants.

Although Peter Waite's plant was used for domestic refrigeration it is a far cry from the neatly packaged slimline refrigerators of today.

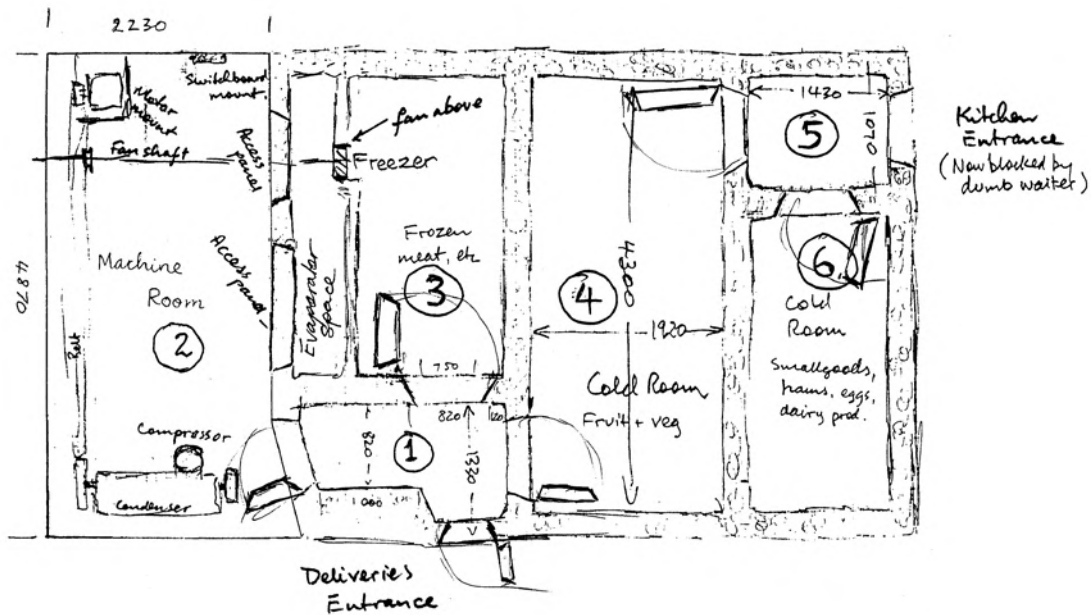
"The machinery was kept separate from the main chilling area, and serviced three main rooms," said Mr White. "Just how cold it was able to keep them is an interesting question."

The first room, which was closest to the evaporation coils and fan, was a meat freezer. The second room had a corrugated iron roof so air was ducted across the ceiling rather than passed directly through the room. It is thought this was done to protect fruit and vegetables from chill burn due to direct contact of chilled air. A third room, the furthest from the fridge plant, was a general purpose cold store with chilled air passed directly through the room.

"Several Australians made significant contributions to the early development of refrigeration technology, so this restoration 100 years after the initial installation will be as much a tribute to work by pioneering Australians as a record of history," said Mr White.

The project will be launched with the first turning of the 'screw' on the compressor at Urrbrae House, Sunday September 3 at 10 : 30 am.

MEDIA CONTACT: Project Coordinator Mr Ray White (08) 332 9100 or Urrbrae House Curator Ms Yvonne Routledge on (08) 303 7425.



Sketch plan of the cold rooms showing building fabric

PROGRAMME

LAUNCH OF RESTORATION OF REFRIGERATION PLANT

SATURDAY SEPTEMBER 3RD [1994] AT 10.30am

1. Professor Harold Woolhouse to welcome guests and speak briefly about the precinct and where the restoration project fits into his vision. Professor Woolhouse to introduce Mr Ray White of White Engineering, a member of the committee organizing the project.
2. Ray White to speak about the project and the early technology.
3. Viewing of the plant and unbolting. Viewing of displays
4. Morning tea in the dining room of Urrbrae House

Photographs of 1994 Launch



- 1. Ray White shows the compressor cylinder
 - 2. Volunteers working in the plant room
 - 3. Rotary light switch and two-pin outlet (minus cover)
 - 4. Air circulation fan
- [Photos: Deane Kemp]

THE INSTITUTION OF ENGINEERS, AUSTRALIA
SA DIVISION
ENGINEERING HERITAGE BRANCH
1996 MEETING PROGRAMME

Thursday 27th June.

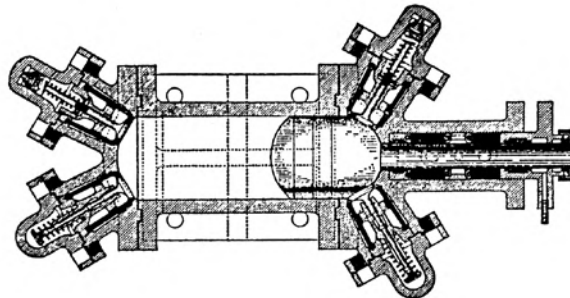
@ 5.30 pm for 6.15 pm.

Urrbrae House, Waite Agricultural Research Institute.

Site visit and talk.

Mr Ray White:: The Urrbrae House Refrigerator and Cold Rooms.

The Institution of Engineers, Australia
S.A. Division
Engineering Heritage Branch



1895 FRIDGE RESTORED

You are invited to an address on the restoration of Australia's oldest domestic refrigerator.

The unit was installed in the basement of Urrbrae House on the University of Adelaide's Waite campus in 1895.

Mr Ray White, of White Refrigeration Pty. Ltd., will present an address which:

- describes the state of refrigeration technology in 1895;

and

- describes the Urrbrae House installation, and the trials and tribulations of its rehabilitation.

The meeting will be held in Urrbrae House from 5.30 p.m. on June 27, 1996 and will include an inspection of the plant in operation.

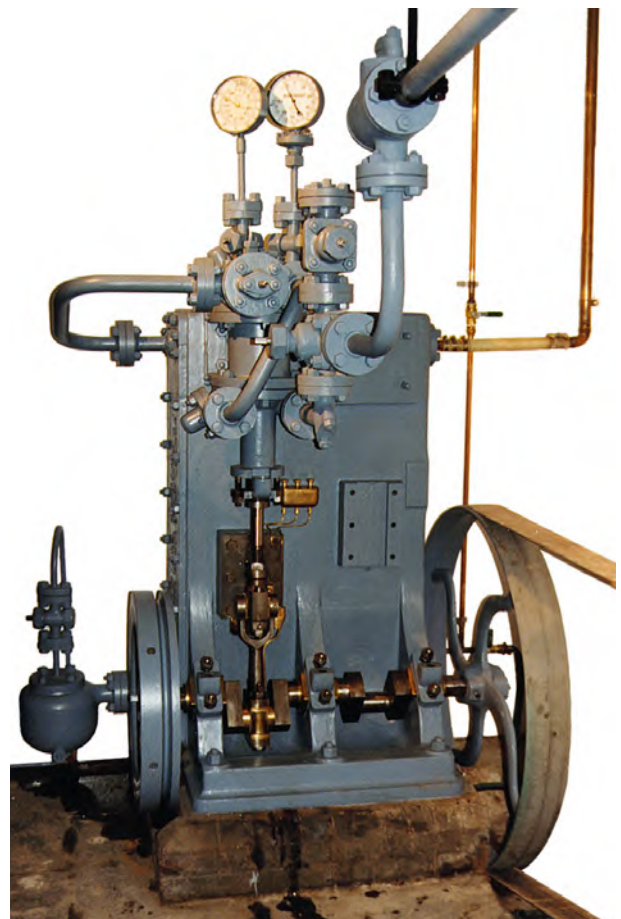
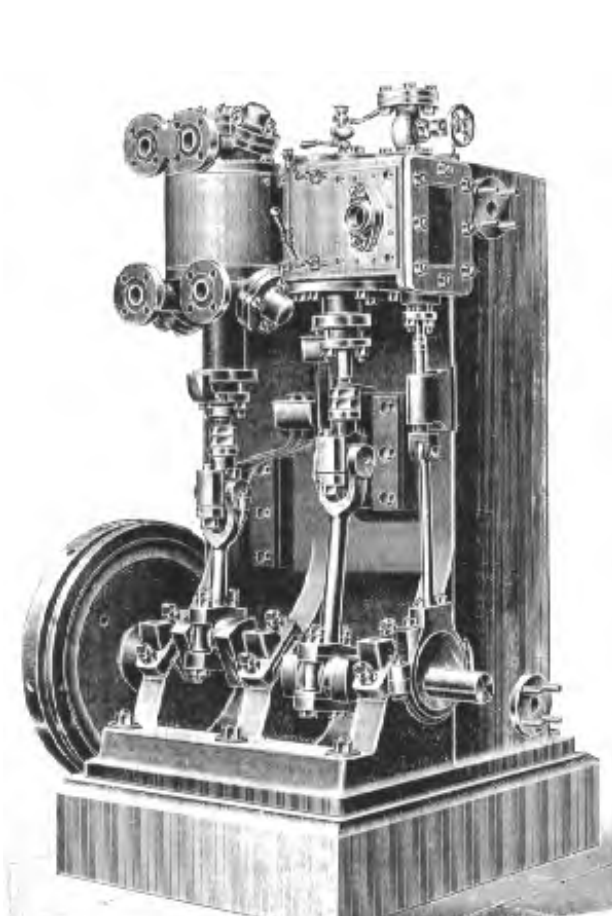
All Institution members and friends, and all others who are interested, are very welcome. To register for the light tea at 5.30 p.m., or for further information, contact Michelle or Brooke on (08) 267 1783 by June 26.

Plant Description (1899) and Comparison

This extract from *The Engineer*, 20 January 1899 [pp 65,66] shows a machine identical to that installed at Urrbrae House except that the Waite machine has no steam cylinder (on the right in the figure).

The description states that the illustration “... shows a self-contained Linde marine machine, such as is used for preserving provisions and making ice on board passenger ships. In those cases it is usual to have two or more insulated compartments in which the desired temperatures are maintained by direct expansion or by brine pipes, the last named being the most usual arrangement. The machine cools brine to a temperature of about zero Fahrenheit, and this cool brine is then circulated partly through brine pipes placed in suitable positions in the rooms, and partly through a tank containing the necessary moulds for ice making. The machine consists of a hollow frame containing the condenser coils. The compressor, which in this case is of the vertical type, is mounted on the front of the frame and driven by a steam engine fixed alongside. The exhaust steam from the engine is generally led into the condenser of the main engine, and in port, when the main engines are not working, either into the auxiliary condenser or the feed tank.”

Comparing the photograph of the Waite compressor with the drawing from *The Engineer*, the mounting pads for the steam cylinder and the crosshead bearing are clearly seen. The right hand end of the crankshaft is fitted with a pulley wheel which was driven by a flat belt from the electric motor.



Wildridge & Sinclair



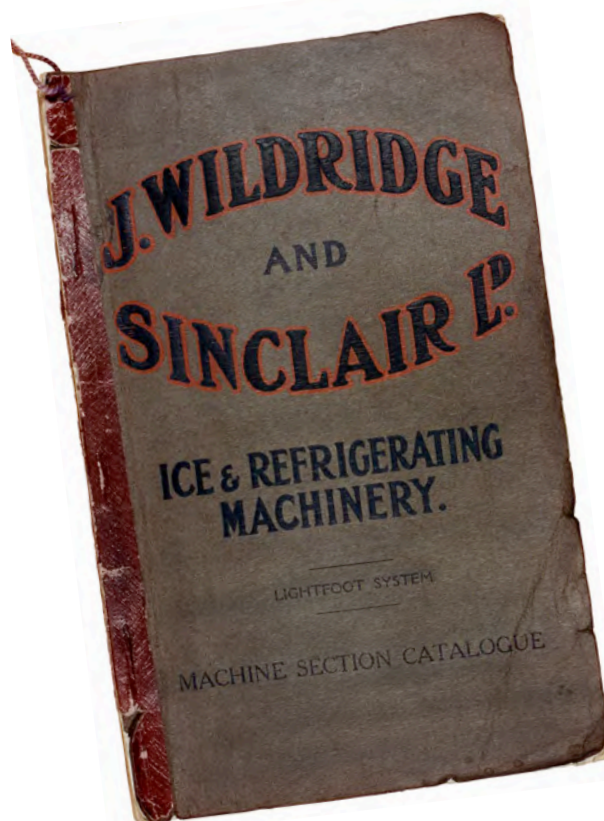
John Wildridge MICE was a consulting engineer and marine surveyor. In June 1889 he was appointed to the Marine Board in Sydney and in 1895 he a member of a board providing advice to the government about the development of the export trade with a particular interest in frozen produce. Prior to forming the partnership with Sinclair, he had been the marine superintendent engineer of the Eastern and Australian Steamship Company, trading to Sydney. Wildridge was recognised as one of the leading authorities in Australian refrigeration and, just before his death on 21 July 1900, he had secured a contract with the South Australian Government for the erection of new plant at the Produce Depot at Port Adelaide on behalf of the Linde Refrigeration Company.

The firm of J Wildridge & Sinclair (Australia) Pty Ltd first opened for business as agents for the Lightfoot-Linde Refrigeration Company of Great Britain. During the early years the partnership was chiefly interested in marine engineering. In the early 1900s, when Sydney Ferries Limited were developing their fleet of wooden-hulled vessels, Wildridge & Sinclair installed the engines in vessels built by Morison & Sinclair of Balmain. (Tom Sinclair of this firm was Russell's brother.) One of that fleet, the double-ended *Kookaburra*, was designed by Russell Sinclair specifically for the Parramatta River Service.

The firm had close links with the development of refrigeration in Australia to serve the growing meat, dairy, cold storage and brewery industries. It developed extensive manufacturing and technical facilities to handle entire projects from initial design through to manufacture, installation, and final commissioning.

According to a company brochure provided by John Beard, a former Managing Director of the firm, Wildridge & Sinclair were among the pioneers of air conditioning and became one of Australia's leading contractors, completing major installations in multi-storey office blocks, hospitals, retail outlets, and shopping centres.

The firm's main office was in Pitt Street, Sydney (occupying at various times Nos 82 and 97); they also had offices in Melbourne (at 590 Elizabeth Street and later at 527 Collins Street). Major works were established in Sydney and Brisbane with smaller workshop facilities in branch offices for miscellaneous general engineering to support service requirements, maintenance work, and prefabrications for site installations.



Russell Sinclair, OBE MIEAust

Russell Sinclair, OBE MIEAust, was born on 25 January 1862 at Greenock, Renfrewshire, Scotland, and was educated at Greenock Academy.

Sinclair trained as an Engineer, serving his time in the Clydeside workshops of Muir & Houston and attending classes at Glasgow University. He later joined the Wallsend Slipway & Engineering Company of Newcastle-on-Tyne and sailed as a marine engineer, mainly in the China Trade.

In 1888, at the age of 26, Sinclair followed the example of his three brothers and settled in Sydney. Shortly after arriving, he formed a partnership with John Wildridge and in 1889 they founded the engineering firm of JWildridge & Sinclair.

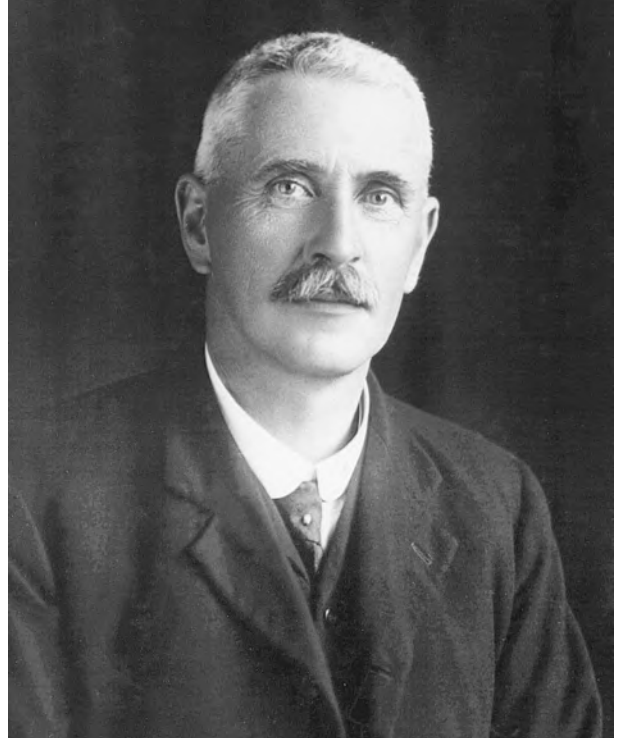
Sinclair was particularly interested in developing the potential of refrigeration, especially to support the export of primary produce and, in 1894, presented a paper on the subject to the Engineering Association of NSW, one of the founding societies of the Institution of Engineers, Australia. He had joined the Association in 1889 and served on the Council for many years. He was Vice President in 1904/05 and was elected President in 1905/06 and 1906/07. In his inaugural address as President, he dealt at length with what were then the latest developments in refrigeration and its potential for the future. Sinclair also published a paper entitled "Refrigerating and Icemaking Machinery, with a description of the Linde System".

During World War I, Sinclair was a member of the Australian Ammunition Committee and made a trip to England on behalf of that Committee. On his return, as Chairman of that committee, he lectured throughout the state to recruit munition workers for service in British factories.

After the Armistice, he was a member of the Commission to expedite the return of soldiers whose presence here was required for special purposes. He was also treasurer of the North Sydney War Chest and organised many efforts to raise funds for the benefit of servicemen.

When the Institution of Engineers, Australia was formed in 1919, Sinclair was admitted as an Associate Member (the grade now known as Member) on 1 December; he was transferred to the grade of Member (now known as Fellow) on 30 March 1920. He was also a Member of the Institution of Mechanical Engineers and a Member of the Institution of Naval Architects. He took an active interest in the Red Cross Society and was for some years its chairman; for this and his services during the War he was awarded the Order of the British Empire.

Russell Sinclair died on 22 September 1930 at his home in Kirribilli.



Urrbrae House Refrigeration Plant and Cold Rooms

location Waite Campus, Urrbrae, South Australia
owner University of Adelaide

the plaque

type **Historic Engineering Marker**

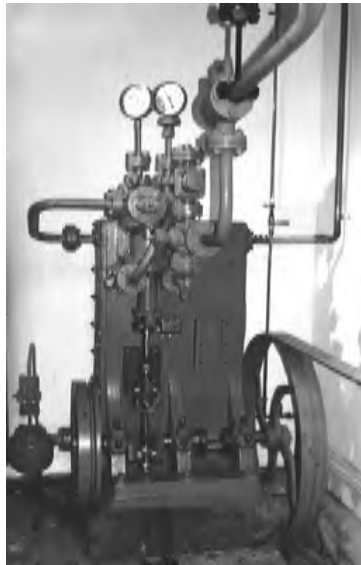
location Front wall of house, adjacent main entrance

plaque text

Urrbrae House Refrigerator and Cold Rooms

This refrigeration plant and cold rooms is the earliest example of domestic refrigeration in Australia. It was installed in 1895 by Wildridge & Sinclair of Sydney (1890-1989) for the pastoralist Peter Waite (1834-1922). It utilises a vertical double-acting ammonia compressor designed in Germany in 1876 by Prof. Carl Linde (1842-1934) and built by Linde British Refrigeration Company. This was the first commercially viable ammonia compressor design and was produced in large numbers.

Dedicated by The Institution of Engineers, Australia and The University of Adelaide, 1996



Russell Sinclair, OBE MIEAust (1862–1930)

Sinclair was born in 1862 in Scotland, and trained as an Engineer, attending classes at Glasgow University and later sailed as a marine engineer, mainly in the China Trade. In 1888, he settled in Sydney and, in partnership with John Wildridge, founded the engineering firm of J Wildridge & Sinclair in 1889.

Sinclair was particularly interested in developing the potential of refrigeration, especially to support the export of primary produce and, in 1894, presented a paper on the subject to the Engineering Association of NSW. In his inaugural address as President of the Association in 1905, he dealt at length with what were then the latest developments in refrigeration and its potential for the future.

During World War I, Sinclair was a member of the Australian Ammunition Committee and made a trip to England on behalf of that Committee. On his return, as Chairman of that committee, he lectured throughout NSW to recruit munition workers for service in British factories.

He was also a Member of the Institution of Mechanical Engineers and a Member of the Institution of Naval Architects. He took an active interest in the Red Cross Society and was for some years its chairman; for this and his services during the War he was awarded the Order of the British Empire.

Russell Sinclair died on 22 September 1930 at his home in Kirribilli.

Proposed layout for IEAust's Heritage Recognition booklet

